

Cell Biology Integrated Review Group (IRG)

The Cell Biology (CB) IRG will review research applications that focus broadly on the study of fundamental cell biological processes, including the functions, interactions and regulation of cells and cellular organelles. This IRG will review applications that involve a variety of disciplines including biochemistry, biophysics, chemistry, and genetics, and use a variety of techniques including microscopy, genomics, proteomics and computational techniques, with the primary goal of better understanding cell functions.

Topics to be covered include cell growth, proliferation and cell cycle control; nuclear architecture and transport; RNA trafficking and localization; post-translational modifications, protein processing, glycosylation and folding; membrane structure and function; lipid traffic and metabolism; cell asymmetry and polarity; ion transport and regulation, channels, transporters and junctions; organelle biogenesis, function, dynamics and protein translocation; the secretory pathway, endocytosis, exocytosis and phagocytosis; degradative processes; cell adhesion, junctions and cell:cell fusion; extracellular matrix and ECM receptors; signaling mechanisms and networks; integrative cell physiology including circadian clocks, stress and oxidative damage response; motors, filaments and cargoes; cell locomotion; mitosis and meiosis; cell death; multi-cellular interactions and development including higher order complexity in tissues; cell differentiation and oncogenic transformation; and the development of new methodologies including advances in imaging and biosensors.

Study Sections recommended for the CB IRG:

Cellular Signaling and Dynamics (CSD): with emphasis on but not limited to cellular homeostasis

Nuclear Dynamics and Transport (NDT): with emphasis on but not limited to intracellular interactions

Intercellular Interactions (ICI): with emphasis on but not limited to extracellular interactions

Cell Structure and Function (CSF): with emphasis on but not limited to cell structure, function, and motility

Membrane Biology and Protein Processing (MBPP): with emphasis on but not limited to cell structure, function, and regulation

Cellular Signaling and Dynamics (CSD)

The Cellular Signaling and Dynamics study section will review applications that focus on the initiation and execution of programs that control cellular homeostasis and physiology. A distinguishing characteristic of these applications is an emphasis on signaling networks and the coordination of processes that have cell-wide consequences. Specific areas include, but are not limited to:

- Integrative cell physiology (e.g., stress, metabolism, clocks, cellular modeling)
- Mitosis and meiosis as related to cell cycle regulation
- Cell differentiation and transformation
- Cell size and mass, asymmetry and polarity
- Control of proliferation and senescence
- Cell death especially in the context of stress, growth and transformation
- Proteolytic mechanisms associated with cell cycle, senescence and death
- Computational modeling of signal transduction

Nuclear Dynamics and Transport (NDT)

The Nuclear Dynamics and Transport study section will consider research applications concerning nuclear aspects of growth, cell cycle control, and regulation of cell death. Nuclear architecture, as related to the assembly of the molecular machinery responsible for RNA synthesis and processing, DNA replication, as well as trafficking into and out of the nucleus will be considered. In addition, many signaling pathways ultimately converge on the nucleus. Cytoskeletal structure and dynamics, the movement of protein and RNA cargoes utilizing molecular motors, and organelle biogenesis will also be covered. Nuclear function, structure, and motor driven movement are also integral to mitosis and meiosis, as well as programmed cell death. Specific areas include, but are not limited to:

- Proliferation and growth control
- Cell cycle regulation, mitosis and checkpoints
- Meiosis
- Cell death
- Filaments, motors and cargoes
- Nuclear architecture, nuclear envelope structure and transport
- Signaling mechanisms and networks that target the nucleus

Intercellular Interactions (ICI)

The Intercellular Interactions study section has an emphasis on how cells interact with both their environment and with neighboring cells, and how this regulates processes associated with cell growth, proliferation, differentiation and higher order complexity in tissues and development. Interest is also focused on how extracellular signals regulate the cytoskeleton and impact cell behavior. Specific areas include, but are not limited to:

- Synthesis, assembly and remodeling of extracellular matrix and cell-cell adhesive structures

- Cell surface adhesive structures in relation to the cytoskeleton, cell polarity and cell proliferation, differentiation and survival
- Regulation of assembly and function of channels, transporters and gap junctions
- The flow of extracellular signals between distinct cells types, cell populations and ECM
- Cell migration, cell-cell fusion, cell organization and morphogenesis as related to tissue organization and development
- Crosstalk between adhesion receptors and other signaling pathways and regulated proteolysis at the cell surface

Cell Structure and Function (CSF)

The Cell Structure and Function study section will focus on the molecular structure and function of cells, with emphasis on applications concerned with membrane structure and function, membrane traffic, organelle biogenesis, extracellular matrix (ECM), cell motility and the cytoskeleton, and their related signaling pathways. Specific areas include, but are not limited to:

- Organelle biogenesis (For example mitochondria, chloroplasts, peroxisomes and lysosomes/vacuoles), including organelle proliferation, segregation, and dynamics
- Targeting, translocation, and processing, including glycosylation, of newly synthesized proteins at membrane compartments
- Cell motility, cytoskeletal dynamics, including their role in morphogenesis
- ECM interactions with the cytoskeleton, and assembly of receptors into junctions and adhesions
- Mechanical properties of cells and the ECM
- Signaling mechanisms related to membrane traffic, cell motility, and cell adhesion.

Membrane Biology and Protein Processing (MBPP)

The Membrane Biology and Protein Processing study section will focus on membrane biology and protein processing. Specific topics include membrane biogenesis; post-translational modification and protein folding; membrane biology including membrane structure and function; vesicular membrane traffic; transport of small molecules across membranes; cell stress response; metabolic pathways including lipid metabolism; degradative processes and proteolytic mechanisms of cell death. Signaling mechanisms regulating these processes would also be appropriate. Specific areas include, but are not limited to:

- Regulation, functions and mechanisms of protein maturation, including folding, chaperone action, post-translational modification, and proteolytic processing
- Membrane traffic in the endocytic and exocytic pathways; mechanisms of protein quality control and sorting; and mechanisms of vesicle formation, targeting and fusion

- Organization of proteins and lipids in cell membranes; metabolism and trafficking of lipids; interactions between proteins and lipids; regulation of signaling by lipid domains
- Cellular physiology and molecular mechanisms of regulation of ion and small molecule transport across membranes via channels, transporters or gap junctions
- Integrative cell physiology (e.g., stress, metabolism, clocks, cellular modeling)
- Degradation of proteins by the ubiquitin/proteasome and lysosomes; limited proteolysis by caspases and calpains; and degradation of extracellular matrix and other macromolecules
- Mechanisms of necrosis and apoptosis, with an emphasis on regulation of caspases, proteolytic pathways responsible for elimination of dead cells, and mitochondrial proteolytic pathways

Shared Interests Within the IRG

The five study sections were purposely designed with significant overlap, and they distinguish themselves in terms of their overall focus. Overlap of specific key areas is summarized here.

Cell growth and proliferation are areas covered by Cellular Signaling and Dynamics, Nuclear Dynamics and Transport, and Intercellular Interactions; cell death is shared by Cellular Signaling and Dynamics, Nuclear Dynamics and Transport, and Membrane Biology and Protein Processing. Cellular Signaling and Dynamics will review applications that emphasize signaling networks and the coordination of processes with cell-wide consequences, while Nuclear Dynamics and Transport will cover aspects of growth and proliferation, and cell death related specifically to nuclear architecture and function. This might include, for example, molecular motors controlling chromosome dynamics in mitosis and meiosis, reassembly of the nucleus and other structures after cell division. Intercellular Interactions will cover aspects of growth and proliferation related specifically to alterations in the extracellular environment; Membrane Biology and Protein Processing will cover aspects of integrative cell physiology, and aspects of cell death related specifically to intracellular architecture and cell death-associated proteolytic events.

All the CB Study Sections include aspects of Signaling Mechanisms and Networks but their foci are somewhat distinct. Cellular Signaling and Dynamics will focus on the coordination of global signaling programs; Nuclear Dynamics and Transport will address signaling from the cytoplasm to the nucleus including pathways that regulate transcriptional control; Intercellular Interactions will cover signaling from the extracellular environment; Cell Structure and Function and Membrane Biology and Protein Processing will cover receptor biogenesis, receptor ligand interactions, down-regulation, and signaling mechanisms related to membrane traffic and cell motility. Thus, it is expected that growth factor signaling might be reviewed by Cellular Signaling and Dynamics, Intercellular Interactions, Cell Structure and Function or Membrane Biology and Protein Processing; small GTPases such as Ras, Rac and Rho could be reviewed in any of the panels depending on the context of the application. Adhesion signaling would be most likely reviewed in Intercellular Interactions but could be handled by Cell Structure and Function; lipid signaling might be reviewed in Membrane Biology and

Protein Processing or Cellular Signaling and Dynamics. Where G-protein coupled receptors interact with ion channels, Cell Structure and Function and Membrane Biology and Protein Processing could review the application. Networks of signaling reactions such as kinase cascades might be reviewed by Cellular Signaling and Dynamics or possibly Nuclear Dynamics and Transport, depending on the breadth of the experiments proposed. Radiation damage induced checkpoint research would be the purview of Cellular Signaling and Dynamics.

Nuclear Dynamics and Transport and Cell Structure and Function share interest in Motors, Filaments and Cargo. However, Nuclear Dynamics and Transport will focus on cytoskeletal components involved in mitotic and meiotic divisions, and will address protein and RNA cargoes for molecular motors, and filamentous proteins with nuclear counterparts. Cell Structure and Function will cover the role of motors and filaments in the process of cell motility and the motor-based transport of vesicle cargoes; Cell Structure and Function will also provide a second venue for reviewing applications on nucleocytoplasmic transport.

Intercellular Interactions shares with Cell Structure and Function the area of Extracellular Matrix and ECM Receptors. Intercellular Interactions will focus on regulation of adhesive structures by changes in the extracellular environment and receptor signaling and how this impacts cell behavior, while Cell Structure and Function will focus on the extracellular matrix and ECM receptors with regard to their interactions with the cytoskeleton.

Cell polarity is covered by the Cellular Signaling and Dynamics and the Intercellular Interactions study sections, while Intercellular Interactions will focus on cell polarity related to regulation by cell-matrix and cell-cell junctions.

Membrane structure will be covered by Membrane Biology and Protein Processing and Cell Structure and Function; Organelle biogenesis, function, dynamics and protein processing will be primarily reviewed by Cell Structure and Function but may also relate to the applications discussed by Nuclear Dynamics and Transport or Membrane Biology and Protein Processing. This topic includes the generation of membrane bound compartments and organelles such as mitochondria, peroxisomes, and ribosomes. Protein translocation into organelles is included in this category, as are the dynamics of organelles inside cells and their partitioning to daughter cells during mitosis. Membrane traffic including the secretory pathway, endocytosis, exocytosis and phagocytosis will be reviewed in Membrane Biology and Protein Processing with overlap into Cell Structure and Function. While Cell Structure and Function will emphasize the relationship between membranes and the cytoskeleton and motors, Membrane Biology and Protein Processing will have a broader focus on membrane cell biology. Post-translational modifications including ubiquitination, sumolation (reaction with small ubiquitin-like modifier), glycosylation etc. will be shared by Membrane Biology and Protein Processing and Cellular Signaling and Dynamics, with Membrane Biology and Protein Processing handling aspects related to specific processes and Cellular Signaling and Dynamics reviewing applications with a more cell-wide focus.

Intercellular Interactions will focus on the regulation of ion transporters, channels and junctions; Cell Structure and Function will focus on the biogenesis, membrane insertion and assembly of ion channels, transporters and junctions, whereas study section

Membrane Biology and Protein Processing will focus ion channel and transporter function in and trafficking to organelles.

Shared interests outside the IRG

We expect cell biological research to be represented broadly among many other IRGs, including cardiovascular sciences, vascular cell and molecular genetics study sections, and oncological sciences.

Biological Chemistry and Macromolecular Biophysics (BCMB): Membrane structure and function is an area of shared interest. Applications that focus on the structure of membrane proteins and channels using biophysical approaches may be assigned to BCMB. Applications that focus on cellular functions such as transport and localization may be assigned to CB, particularly Cell Structure and Function or Membrane Biology and Protein Processing.

Genes, Genomes, and Genetics (GGG): Shared interests include chromosome duplication and dynamics, nucleocytoplasmic trafficking, analysis of gene function, and signal transduction pathways. If the focus is on molecular genetic mechanisms and/or regulation of DNA metabolism or gene expression, assignment may be to GGG. If the focus is on mitotic processes or on cytoskeletal or nuclear envelope assembly and dynamics, assignment may be to CB, particularly Cell Structure and Function. Studies on nuclear transport, cell cycle control, apoptosis, and signaling pathways should be assigned on the basis of the central question addressed by the application.

Biology of Development and Aging (BDA): Studies of development and aging at the cellular level are areas of shared interest. Cell biological studies may be assigned to BDA when they emphasize a developmental or aging question. If the focus is cell biological, then assignment to CB may be appropriate.

Bioengineering Sciences and Technologies (BST): Shared interests include studies of gene and cell delivery, cell imaging, management and analysis of cell biological data, computational or database tools for analysis of cell physiological processes or signal transduction, cell separations, and cell interfaces with biomaterials. If the focus is development of new technology, assignment to BST may be appropriate. If the focus is a basic cell process or principle or the application of an emerging technique to a cell biological problem, assignment to CB may be appropriate.

Immunology (IMM), Infectious Diseases & Microbiology (IDM), AIDS & Related Research (AARR), Oncological Sciences (ONC), Hematology (HEME), Cardiovascular Sciences (CVS), Endocrinology, Metabolism, Nutrition, & Reproductive Sciences (EMNR), Musculoskeletal, Oral, & Skin Sciences (MOSS), Digestive Sciences (DIG), Respiratory Sciences (RES), and Renal & Urological Sciences (RUS): Studies of cellular processes in the context of a specific organ or disease are areas of shared interests. If the focus is on the organ or disease, then assignment to an organ or disease IRG may be appropriate. If the focus is on a basic cell process, on an emerging cell biologic approach, or on a multi-organ disease, then assignment to CB may be appropriate.

Molecular, Cellular, & Developmental Neuroscience (MDCN), Integrative, Functional, & Cognitive Neuroscience (IFCN), and Brain Disorders & Clinical Neuroscience (BDCN): Cellular studies of the nervous system are a shared interest. If the focus is

neuroscience, then assignment to a neuroscience IRG may be appropriate. If the focus is a basic cell process or on an emerging cell biologic approach, then assignment to CB may be appropriate.